Lab Testing Errors and Delays and Temporal Differences in Inter-departmental Coordination in Hospital: A Case of Emergency Department and Core Lab

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Abstract

Context: We studied the inter-departmental coordination of information between the emergency department (ED) and the core laboratory (lab) of a metropolitan medical center with approximately775,000 ED patient visits yearly.

Objectives: Our primary goal was to identify sources of sample errors and delays in lab testing and to generate possible solutions to these problems.

Methods: We conducted field observations (69.5 hours) in the ED and the lab, and 25 interviews with physicians, nurses, paramedics, and other administrative staffs in the ED and the lab technicians in the lab.

Results: We found that fundamental to the sample errors and delays in lab testing is that these two departments operate under two different temporal arrangements. While the ED is organized to cope with the *concurrent* nature of the tasks, the lab is organized with a *linear* temporal pattern that reflects the sequential processing of tests. In order to cope with such temporal differences, the members of these departments created work-arounds, which often became sources of errors and delays. Furthermore, we found that the lack of local awareness what happened in both systems simultaneously created additional errors and delays.

Conclusions: In order to improve quality of care and efficiency, we need to consider better ways to coordinate between different temporal systems in a hospital. We plan to introduce more effective mechanisms (including new procedures, social norms and IT artifacts) that can effectively coordinate these temporal systems.

MOTIVATION

❑**Temporal differences** between the Emergency Department (ED) and the Core Lab (lab) because the two departments subscribe to alternate temporal arrangements

❑**Sample errors and delays** resulted from the interactions between the two temporally asymmetric departments in lab testing

❑**Reduce sample errors and minimize sample delays** in lab testing and streamline the cooperation between the ED and the lab

DATA COLLECTION

❑**Field observations** – a total of 69.5 hours in the field
- •Shadowing the medical staff (e.g., physicians, charge nurse, nurse, clinical technician assistant, and paramedics) in the ED and having conversations with them while following them around
- •Shadowing in the technicians in the lab

❑**Formal Interviews** – a total of 25 interview
- •Interviews with the ED personnel (e.g., physicians and nurses)
- •Interviews with the lab technicians from the lab

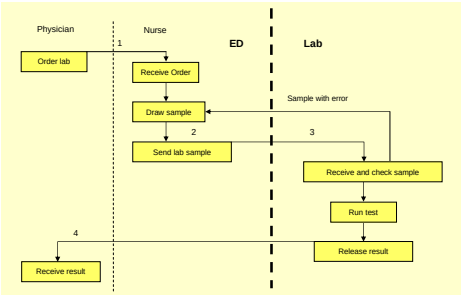
TEMPORAL DIFFERENCE

	ED	Lab
Outside party to interact with	Interact with many different outside parties, such as the lab, the EMS, the radiology department, the CT department, the specialized department, patients' private physicians, and outside expertise, etc.	Mainly respond to the samples sent up by the ED, and occasionally interact with other specialized labs when it can't run specific lab tests
Task execution strategy	Physicians and nurses in the ED deal with several patients in a same time span, and the activities performed on different patients are inter-meshed (multi-tasking)	Adopt a linear task completion strategy, that is, handle one sample at one time, although the samples from the ED come irregularly and unevenly
Tempo of activities	Fast-paced and is expected to work fast in face of the temporal disorder	Relatively slower-paced in a less temporally chaotic environment
Sense of scarcity	Work under tight temporal frames, experience "running out" of time and usually feel that not enough time is available to complete activities	Have a more temporally relaxing environment, and experience less pressure temporally
Sense of urgency	Interact directly with patients, and the speed of service varies with the total volume and the acuity of patients	Work in the back stage of the healthcare delivery, and the speed of service is, more or less, consistent, independent of the total volume and the acuity of patients

These differences in the use and meanings of time between the ED and the lab are reflected in their different values and expected behavior patterns, and create the temporal boundary between the ED and the lab.

SAMPLE DELAYS

The Typical Flow of Sample



1, 2, 3 and 4 indicate the potential delays

The Sources and Causes of Delays

Delay	Source	Cause
1	Physicians' ordering a lab test and nurses' drawing the sample: the information of physicians' orders is passed to nurses via the lab order print-outs and the white board	Lack of clarity in multiple modes of communication for ordering and drawing samples within the ED
2	Drawing a sample and sending it to the lab: all pneumatic tube carriers are in the lab	Resource dependency of ED on the lab: pneumatic tube carriers are unavailable in the ED
3	Receiving the sample in the lab: the pneumatic tube carriers arrive at the lab and are not picked up by a lab technician	The lab's lack of awareness of the workload coming from the ED
4	Releasing a lab result by the lab and receiving it in the ED: information of a lab result is passed to the ED electronically and via a paper print-out in the ED	The ED's lack of awareness that the lab has completed

SAMPLE ERRORS

❑**Types of Errors**
- ▪Labeling errors: unlabeled samples, and mislabeled samples
- ▪Specimen errors: specimens with wrong volume, and unsigned specimens

❑**Sources of Errors**
- ▪Mistakenly used sample label print-outs
- ▪Change of hands during processing a sample (i.e., person A draws the sample, person B labels the sample, and person C sends the sample up to the lab through the tube system)
- ▪Interruptions in busy time

❑**Roots of Errors**
- ▪Variability in the practice of drawing and labeling samples (i.e., not an end-to-end process)
- ▪Transferring responsibility when one sample is handled by different people
- ▪Not enough clear and visible guidelines of standard procedures in handling samples

❑**Multi-tasking and Errors**
- •The ED nurses and paramedics multi-tasking
  - •Juggle several patients and activities at once to maximize their time in response to various stimuli (e.g., the coming to new patients, the physicians' ordering of lab tests, etc.) in their working environment
- •More sample errors in the busy time than in the slow time in the ED
  - •Some nurses lose composure in the busy time, and as a result, labels of and samples from different patients are mixed up, volumes of specimens low, samples not labeled at all

FUTURE WORK

❑**Create greater awareness and understanding of the temporal differences between the ED and the lab**
- ▪Send the ED nurses and paramedics to visit the lab and the lab technicians to visit the ED to better understand the different work organizations in the two departments

❑**Improve the communication and coordination between the ED and the lab**
- ▪ The potential to set up a process status board in the ED and the lab
- ▪ The possibility of incorporating information technology in coordination between the two departments
- ▪Streamline the communication process between the two departments when sample errors occur

❑**Re-design the work procedures to better accommodate the temporal differences between the ED and the lab**